FIG. 1

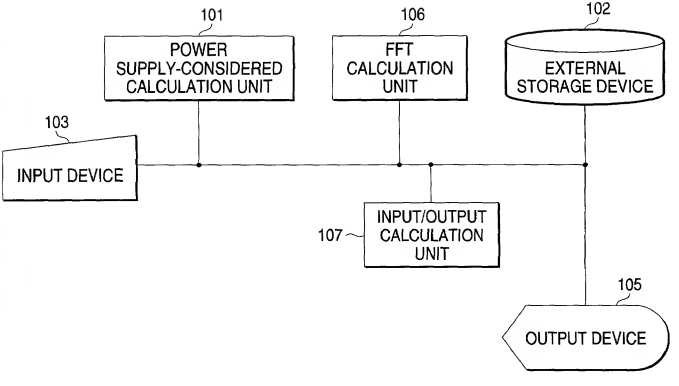

101
POWER SUPPLY-CONSIDERED CALCULATION UNIT
106
FFT CALCULATION UNIT
102
EXTERNAL STORAGE DEVICE
103
INPUT DEVICE
107
INPUT/OUTPUT CALCULATION UNIT
105
OUTPUT DEVICE

FIG. 2

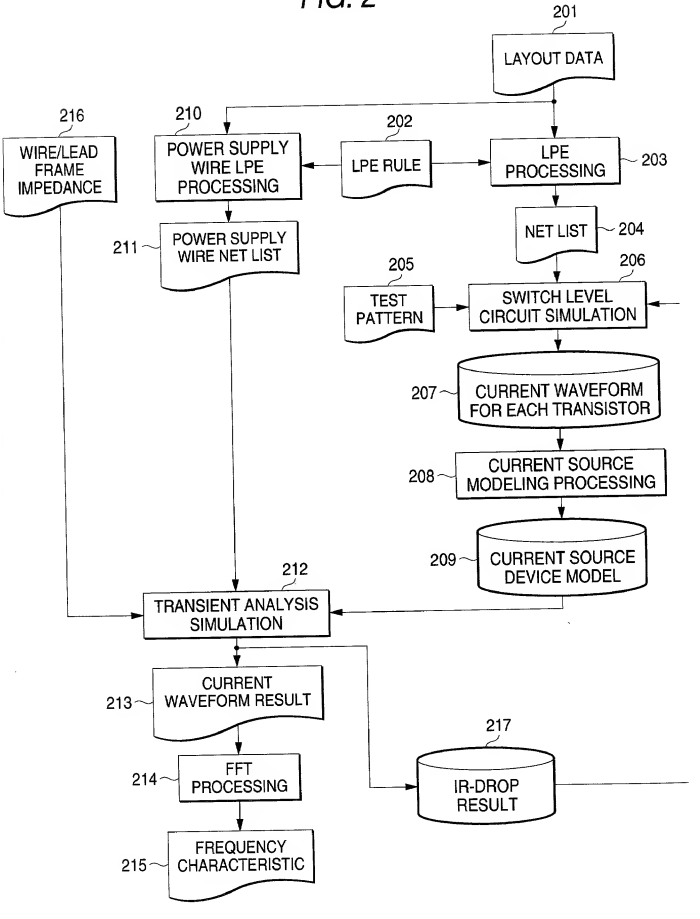


FIG. 3

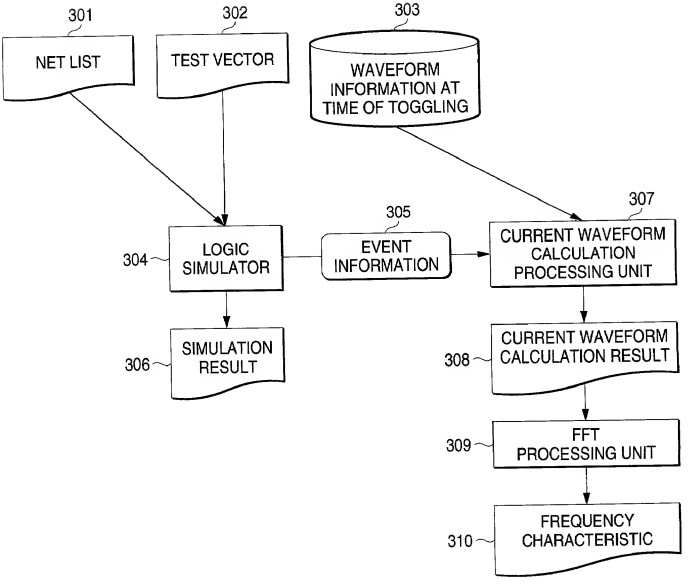

301
NET LIST
302
TEST VECTOR
303
WAVEFORM INFORMATION AT TIME OF TOGGLING
304
LOGIC SIMULATOR
305
EVENT INFORMATION
307
CURRENT WAVEFORM CALCULATION PROCESSING UNIT
306
SIMULATION RESULT
308
CURRENT WAVEFORM CALCULATION RESULT
309
FFT PROCESSING UNIT
310
FREQUENCY CHARACTERISTIC

FIG. 4

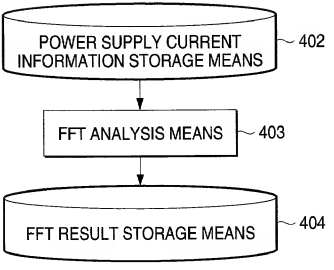

POWER SUPPLY CURRENT INFORMATION STORAGE MEANS
402
FFT ANALYSIS MEANS
403
FFT RESULT STORAGE MEANS
404

FIG. 5

FREQUENCY [MHz]	CURRENT FREQUENCY COMPONENT [mA]
0	10
5	1
10	1
15	1
20	1
25	1
30	1
35	1
40	1
45	30
50	70
55	30
55	30
60	1
65	1
70	1
75	1
80	1
85	1
90	1
95	20
100	50
105	20
110	1
115	1
120	1
125	1

501 502

FIG. 6

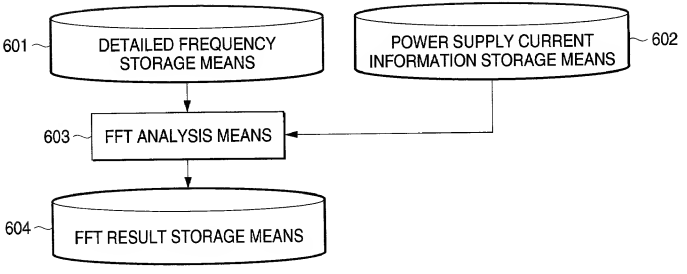


FIG. 7

START FREQUENCY [MHz]	END FREQUENCY [MHz]
45	55
95	105

701 702

FIG. 8

TIME [ns]	POWER SUPPLY CURRENT VALUE [mA]
0	0
95	20
100	50
105	20
195	30
200	70
205	30
295	20
300	50
305	20
395	30
400	70
405	30
495	20
500	30
505	20

801 802

FIG. 9

FREQUENCY [MHz]	CURRENT FREQUENCY COMPONENT [mA]
0	10
25	1
45	30
50	70
55	30
75	1
95	20
100	50
105	20
125	1

901 902

FIG. 10

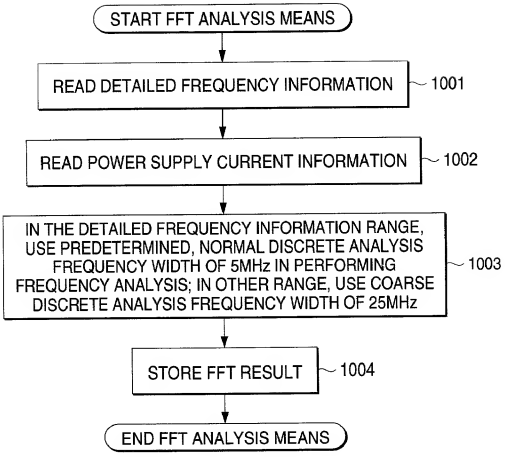

START FFT ANALYSIS MEANS
READ DETAILED FREQUENCY INFORMATION
1001
READ POWER SUPPLY CURRENT INFORMATION
1002
IN THE DETAILED FREQUENCY INFORMATION RANGE, USE PREDETERMINED, NORMAL DISCRETE ANALYSIS FREQUENCY WIDTH OF 5MHz IN PERFORMING FREQUENCY ANALYSIS; IN OTHER RANGE, USE COARSE DISCRETE ANALYSIS FREQUENCY WIDTH OF 25MHz
1003
STORE FFT RESULT
1004
END FFT ANALYSIS MEANS

FIG. 11

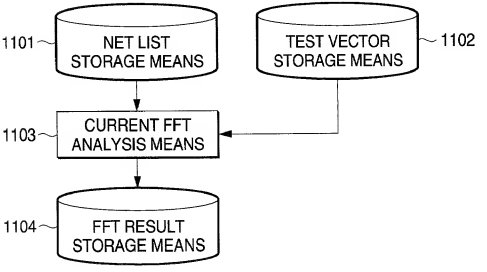

1101
NET LIST STORAGE MEANS
TEST VECTOR STORAGE MEANS
1102
1103
CURRENT FFT ANALYSIS MEANS
1104
FFT RESULT STORAGE MEANS

FIG. 12

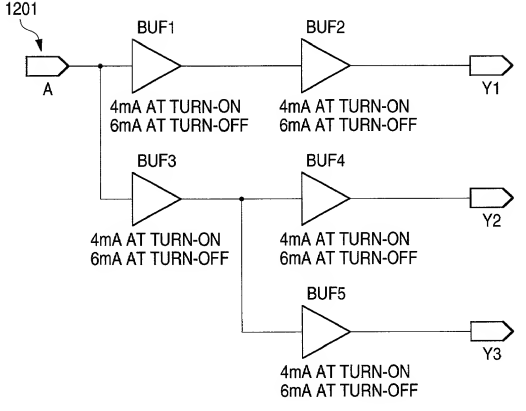


FIG. 13

TIME [ns]	EXTERNAL INPUT TERMINAL NAME	VOLTAGE VALUE [V]
0	A	0
90	A	2.5
190	A	0
290	A	2.5
390	A	0
490	A	2.5

1301 1302 1303

FIG. 14

FREQUENCY [MHz]	CURRENT FREQUENCY COMPONENT [mA]
0	10
5	1
10	1
15	1
20	1
25	1
30	1
35	1
40	1
45	30
50	70
55	30
55	30
60	1
65	1
70	1
75	1
80	1
85	1
90	1
95	20
100	50
105	20
110	1
115	1
120	1
125	1

1401 1402

FIG. 15

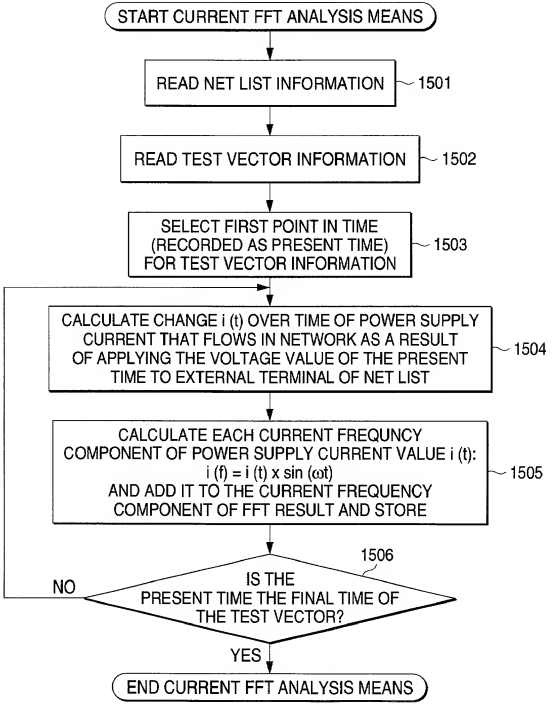

START CURRENT FFT ANALYSIS MEANS
READ NET LIST INFORMATION
1501
READ TEST VECTOR INFORMATION
1502
SELECT FIRST POINT IN TIME (RECORDED AS PRESENT TIME) FOR TEST VECTOR INFORMATION
1503
CALCULATE CHANGE i (t) OVER TIME OF POWER SUPPLY CURRENT THAT FLOWS IN NETWORK AS A RESULT OF APPLYING THE VOLTAGE VALUE OF THE PRESENT TIME TO EXTERNAL TERMINAL OF NET LIST
1504
CALCULATE EACH CURRENT FREQUNCY COMPONENT OF POWER SUPPLY CURRENT VALUE i (t): i (f) = i (t) x sin (ωt) AND ADD IT TO THE CURRENT FREQUENCY COMPONENT OF FFT RESULT AND STORE
1505
1506
IS THE PRESENT TIME THE FINAL TIME OF THE TEST VECTOR?
NO
YES
END CURRENT FFT ANALYSIS MEANS

FIG. 16

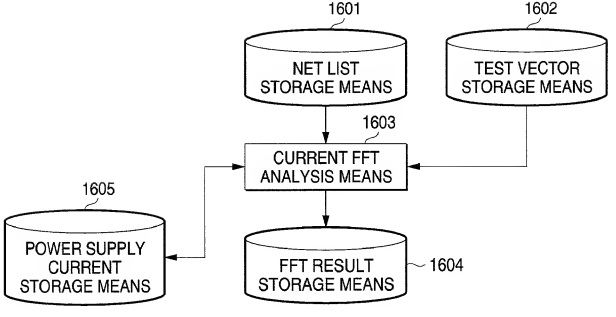

1601
NET LIST STORAGE MEANS
1602
TEST VECTOR STORAGE MEANS
1603
CURRENT FFT ANALYSIS MEANS
1605
POWER SUPPLY CURRENT STORAGE MEANS
FFT RESULT STORAGE MEANS
1604

FIG. 17

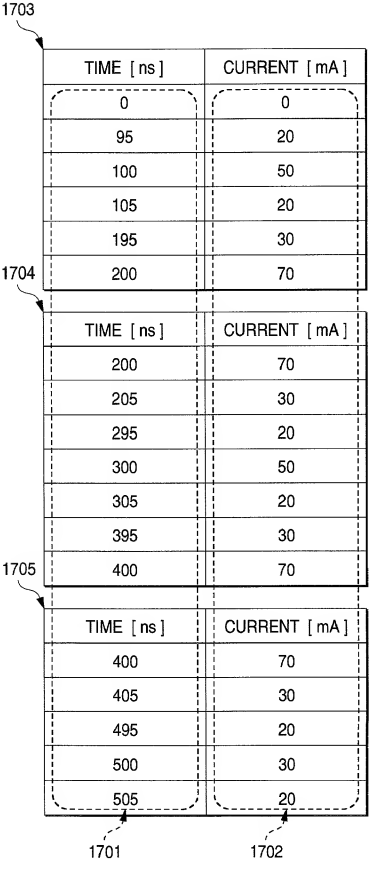

1703
TIME [ns]
CURRENT [mA]
0
0
95
20
100
50
105
20
195
30
200
70
1704
TIME [ns]
CURRENT [mA]
200
70
205
30
295
20
300
50
305
20
395
30
400
70
1705
TIME [ns]
CURRENT [mA]
400
70
405
30
495
20
500
30
505
20
1701
1702

FIG. 18

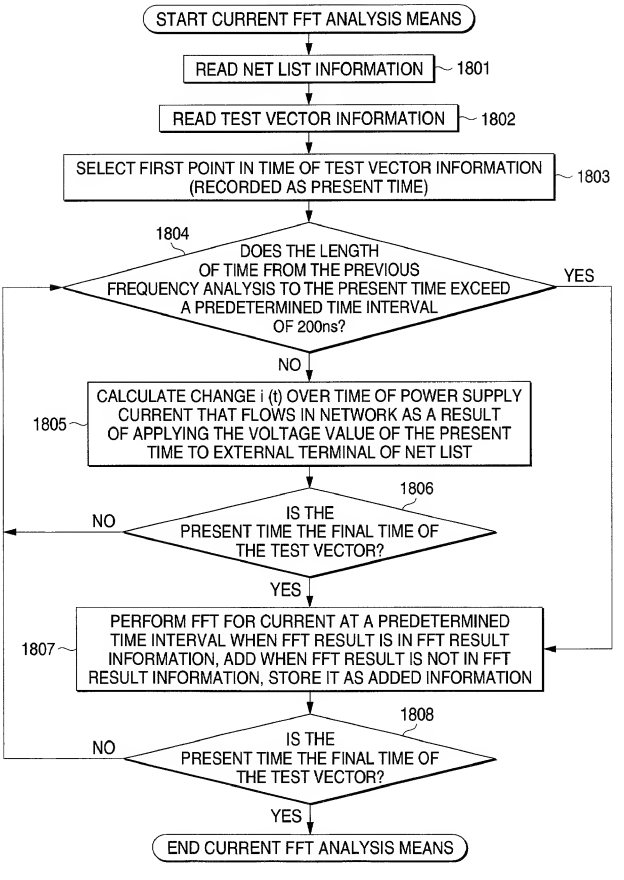

START CURRENT FFT ANALYSIS MEANS
READ NET LIST INFORMATION
1801
READ TEST VECTOR INFORMATION
1802
SELECT FIRST POINT IN TIME OF TEST VECTOR INFORMATION (RECORDED AS PRESENT TIME)
1803
1804
DOES THE LENGTH OF TIME FROM THE PREVIOUS FREQUENCY ANALYSIS TO THE PRESENT TIME EXCEED A PREDETERMINED TIME INTERVAL OF 200ns?
YES
NO
CALCULATE CHANGE i (t) OVER TIME OF POWER SUPPLY CURRENT THAT FLOWS IN NETWORK AS A RESULT OF APPLYING THE VOLTAGE VALUE OF THE PRESENT TIME TO EXTERNAL TERMINAL OF NET LIST
1805
1806
IS THE PRESENT TIME THE FINAL TIME OF THE TEST VECTOR?
NO
YES
PERFORM FFT FOR CURRENT AT A PREDETERMINED TIME INTERVAL WHEN FFT RESULT IS IN FFT RESULT INFORMATION, ADD WHEN FFT RESULT IS NOT IN FFT RESULT INFORMATION, STORE IT AS ADDED INFORMATION
1807
1808
IS THE PRESENT TIME THE FINAL TIME OF THE TEST VECTOR?
NO
YES
END CURRENT FFT ANALYSIS MEANS

FIG. 19

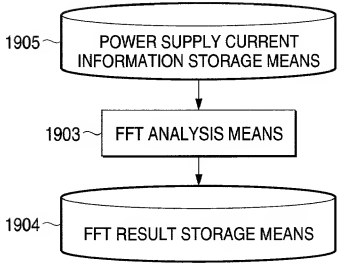


FIG. 20

FREQUENCY [MHz]	CURRENT FREQUENCY COMPONENT [mA]
0	10
45	30
50	70
55	30
95	20
100	50
105	20

2001 2002

FIG. 21

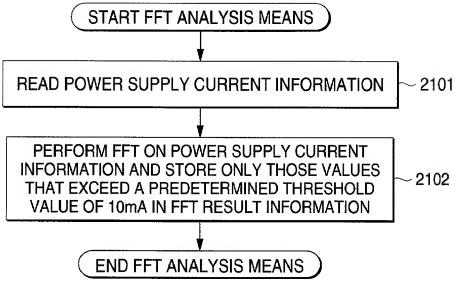

START FFT ANALYSIS MEANS
READ POWER SUPPLY CURRENT INFORMATION
2101
PERFORM FFT ON POWER SUPPLY CURRENT INFORMATION AND STORE ONLY THOSE VALUES THAT EXCEED A PREDETERMINED THRESHOLD VALUE OF 10mA IN FFT RESULT INFORMATION
2102
END FFT ANALYSIS MEANS

FIG. 22

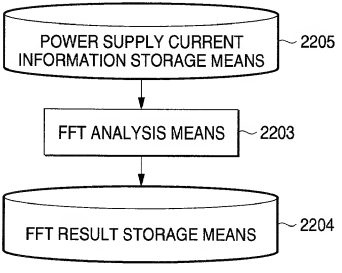

POWER SUPPLY CURRENT INFORMATION STORAGE MEANS
2205
FFT ANALYSIS MEANS
2203
FFT RESULT STORAGE MEANS
2204

FIG. 23

FREQUENCY [MHz]	CURRENT FREQUENCY COMPONENT [mA]
50	70
100	50
45	30
55	30
95	20
105	20

2301 2302

FIG. 24

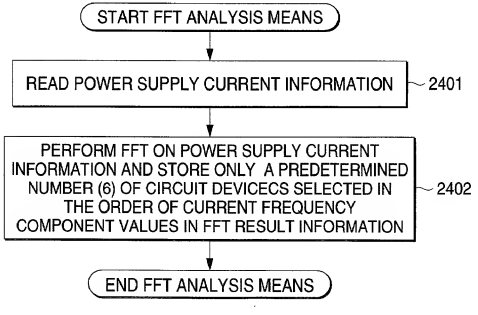


FIG. 25

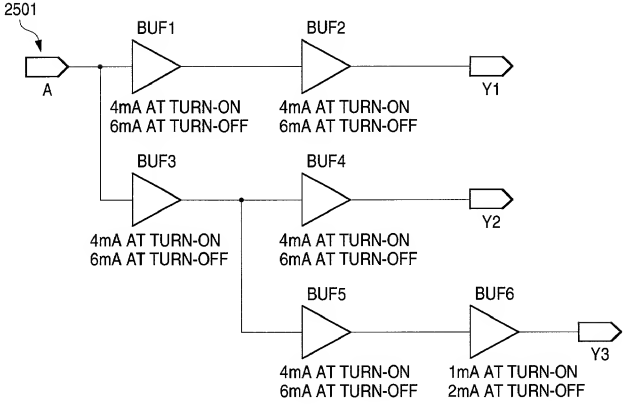


FIG. 26

CIRCUIT DEVICE TO BE EMI-ANALYZED
BUF1
BUF2
BUF3
BUF4
BUF5

FIG. 27

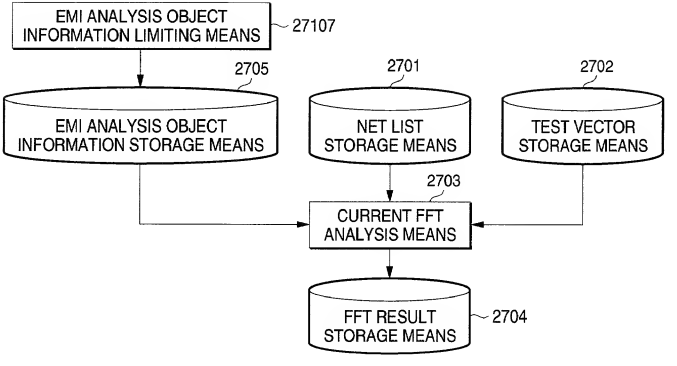

EMI ANALYSIS OBJECT INFORMATION LIMITING MEANS
27107
2705
EMI ANALYSIS OBJECT INFORMATION STORAGE MEANS
2701
NET LIST STORAGE MEANS
2702
TEST VECTOR STORAGE MEANS
2703
CURRENT FFT ANALYSIS MEANS
FFT RESULT STORAGE MEANS
2704

FIG. 28

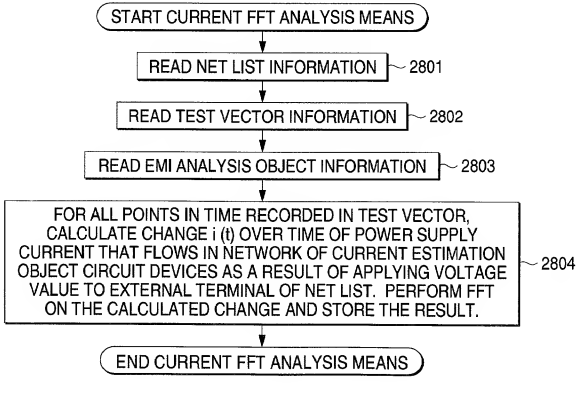

START CURRENT FFT ANALYSIS MEANS
READ NET LIST INFORMATION
2801
READ TEST VECTOR INFORMATION
2802
READ EMI ANALYSIS OBJECT INFORMATION
2803
FOR ALL POINTS IN TIME RECORDED IN TEST VECTOR, CALCULATE CHANGE i (t) OVER TIME OF POWER SUPPLY CURRENT THAT FLOWS IN NETWORK OF CURRENT ESTIMATION OBJECT CIRCUIT DEVICES AS A RESULT OF APPLYING VOLTAGE VALUE TO EXTERNAL TERMINAL OF NET LIST. PERFORM FFT ON THE CALCULATED CHANGE AND STORE THE RESULT.
2804
END CURRENT FFT ANALYSIS MEANS

FIG. 29

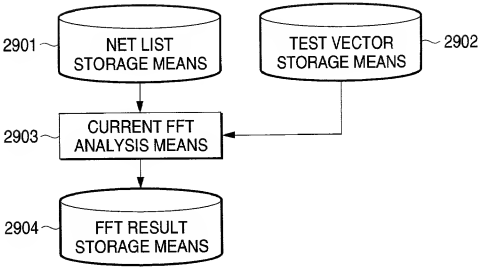

2901
NET LIST STORAGE MEANS
TEST VECTOR STORAGE MEANS
2902
2903
CURRENT FFT ANALYSIS MEANS
2904
FFT RESULT STORAGE MEANS

FIG. 30

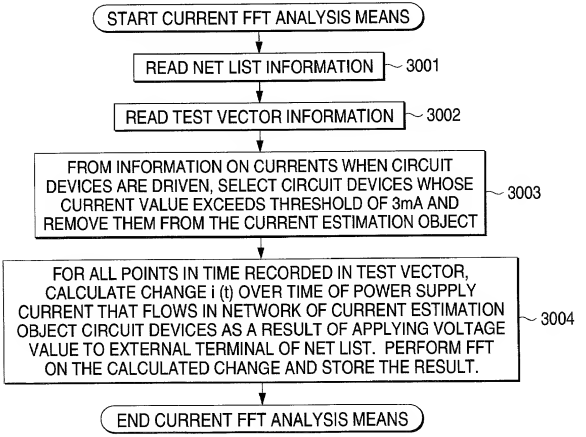

START CURRENT FFT ANALYSIS MEANS
READ NET LIST INFORMATION
3001
READ TEST VECTOR INFORMATION
3002
FROM INFORMATION ON CURRENTS WHEN CIRCUIT DEVICES ARE DRIVEN, SELECT CIRCUIT DEVICES WHOSE CURRENT VALUE EXCEEDS THRESHOLD OF 3mA AND REMOVE THEM FROM THE CURRENT ESTIMATION OBJECT
3003
FOR ALL POINTS IN TIME RECORDED IN TEST VECTOR, CALCULATE CHANGE i (t) OVER TIME OF POWER SUPPLY CURRENT THAT FLOWS IN NETWORK OF CURRENT ESTIMATION OBJECT CIRCUIT DEVICES AS A RESULT OF APPLYING VOLTAGE VALUE TO EXTERNAL TERMINAL OF NET LIST. PERFORM FFT ON THE CALCULATED CHANGE AND STORE THE RESULT.
3004
END CURRENT FFT ANALYSIS MEANS

FIG. 31

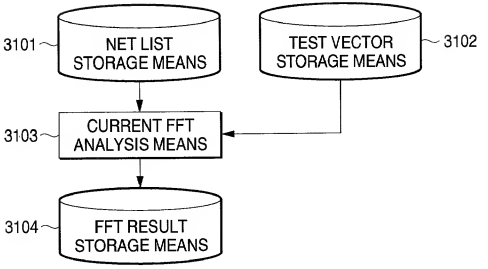

3101
NET LIST STORAGE MEANS
TEST VECTOR STORAGE MEANS
3102
3103
CURRENT FFT ANALYSIS MEANS
3104
FFT RESULT STORAGE MEANS

FIG. 32

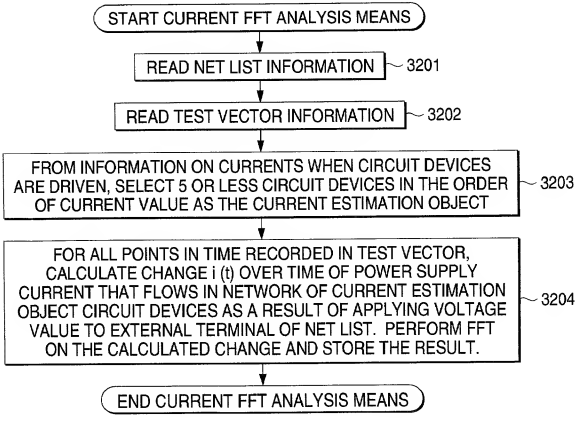

START CURRENT FFT ANALYSIS MEANS
READ NET LIST INFORMATION
3201
READ TEST VECTOR INFORMATION
3202
FROM INFORMATION ON CURRENTS WHEN CIRCUIT DEVICES ARE DRIVEN, SELECT 5 OR LESS CIRCUIT DEVICES IN THE ORDER OF CURRENT VALUE AS THE CURRENT ESTIMATION OBJECT
3203
FOR ALL POINTS IN TIME RECORDED IN TEST VECTOR, CALCULATE CHANGE i (t) OVER TIME OF POWER SUPPLY CURRENT THAT FLOWS IN NETWORK OF CURRENT ESTIMATION OBJECT CIRCUIT DEVICES AS A RESULT OF APPLYING VOLTAGE VALUE TO EXTERNAL TERMINAL OF NET LIST. PERFORM FFT ON THE CALCULATED CHANGE AND STORE THE RESULT.
3204
END CURRENT FFT ANALYSIS MEANS

FIG. 33

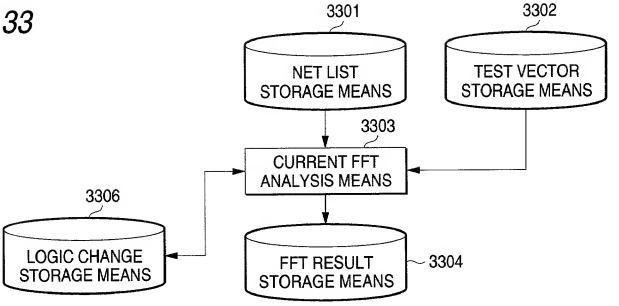

3301
NET LIST STORAGE MEANS
3302
TEST VECTOR STORAGE MEANS
3303
CURRENT FFT ANALYSIS MEANS
3306
LOGIC CHANGE STORAGE MEANS
FFT RESULT STORAGE MEANS
3304

FIG. 34

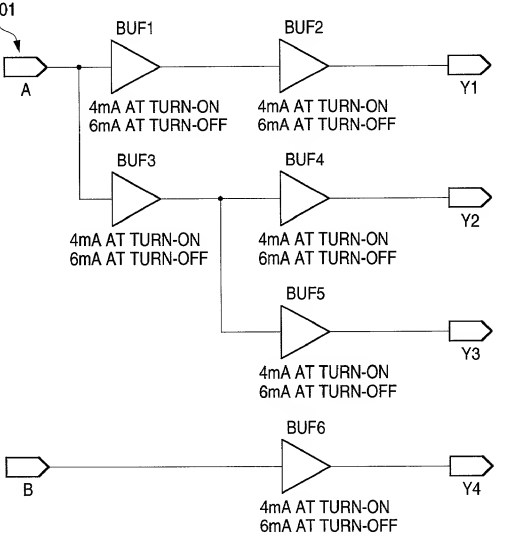

3401
A
BUF1
4mA AT TURN-ON
6mA AT TURN-OFF
BUF2
4mA AT TURN-ON
6mA AT TURN-OFF
Y1
BUF3
4mA AT TURN-ON
6mA AT TURN-OFF
BUF4
4mA AT TURN-ON
6mA AT TURN-OFF
Y2
BUF5
4mA AT TURN-ON
6mA AT TURN-OFF
Y3
B
BUF6
4mA AT TURN-ON
6mA AT TURN-OFF
Y4

FIG. 35

TIME [ns]	EXTERNAL TERMINAL NAME	LOGIC VALUE
0	A	0
90	A	1
190	A	0
290	A	1
390	A	0
490	A	1
0	B	0
190	B	1
390	B	0

3501 3502 3503

FIG. 36

TIME [ns]	ELEMENT NAME	LOGIC VALUE
0	BUF1, BUF2, BUF3, BUF4, BUF 5	0
90	BUF1, BUF2, BUF3, BUF4, BUF 5	1
190	BUF1, BUF2, BUF3, BUF4, BUF 5	0
290	BUF1, BUF2, BUF3, BUF4, BUF 5	1
390	BUF1, BUF2, BUF3, BUF4, BUF 5	0
490	BUF1, BUF2, BUF3, BUF4, BUF 5	1
0	BUF6	0
190	BUF6	1
390	BUF6	0

3601 3602 3603

FIG. 37

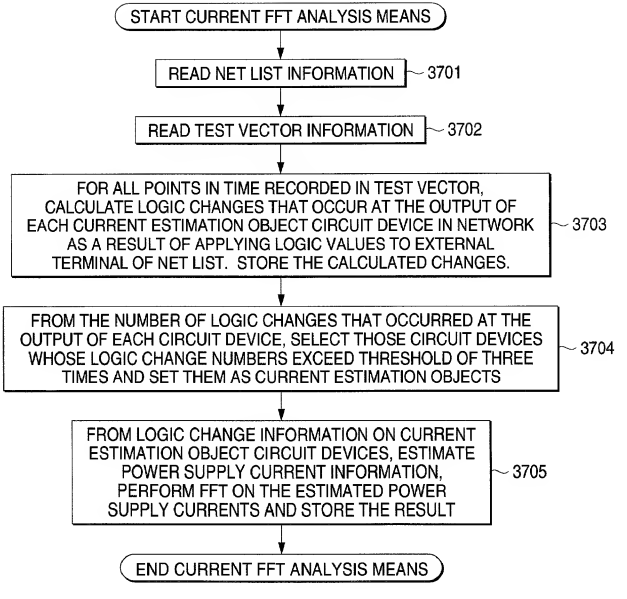

START CURRENT FFT ANALYSIS MEANS
READ NET LIST INFORMATION
3701
READ TEST VECTOR INFORMATION
3702
FOR ALL POINTS IN TIME RECORDED IN TEST VECTOR, CALCULATE LOGIC CHANGES THAT OCCUR AT THE OUTPUT OF EACH CURRENT ESTIMATION OBJECT CIRCUIT DEVICE IN NETWORK AS A RESULT OF APPLYING LOGIC VALUES TO EXTERNAL TERMINAL OF NET LIST. STORE THE CALCULATED CHANGES.
3703
FROM THE NUMBER OF LOGIC CHANGES THAT OCCURRED AT THE OUTPUT OF EACH CIRCUIT DEVICE, SELECT THOSE CIRCUIT DEVICES WHOSE LOGIC CHANGE NUMBERS EXCEED THRESHOLD OF THREE TIMES AND SET THEM AS CURRENT ESTIMATION OBJECTS
3704
FROM LOGIC CHANGE INFORMATION ON CURRENT ESTIMATION OBJECT CIRCUIT DEVICES, ESTIMATE POWER SUPPLY CURRENT INFORMATION, PERFORM FFT ON THE ESTIMATED POWER SUPPLY CURRENTS AND STORE THE RESULT
3705
END CURRENT FFT ANALYSIS MEANS

FIG. 38

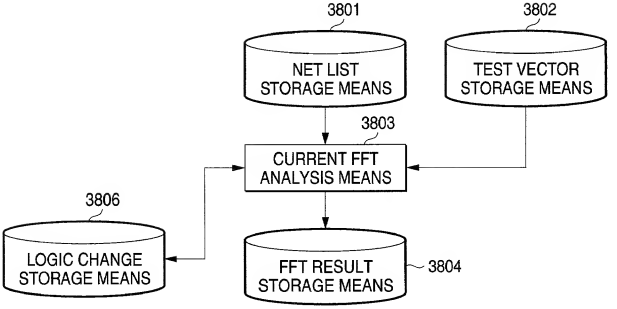

3801
NET LIST
STORAGE MEANS
3802
TEST VECTOR
STORAGE MEANS
3803
CURRENT FFT
ANALYSIS MEANS
3806
LOGIC CHANGE
STORAGE MEANS
FFT RESULT
STORAGE MEANS
3804

FIG. 39

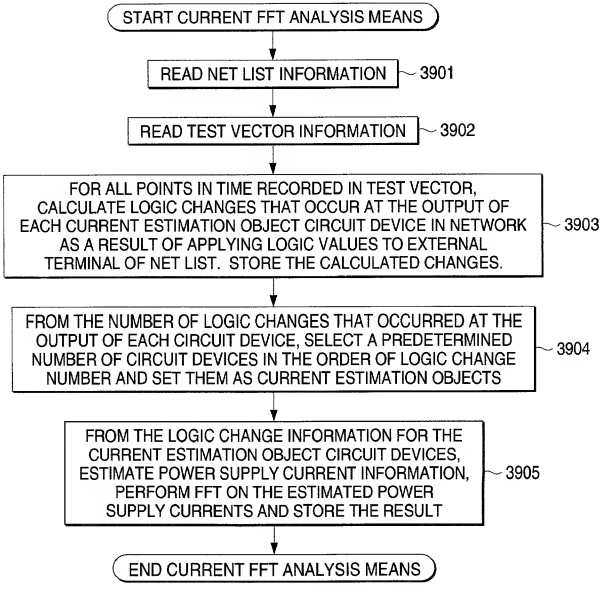

START CURRENT FFT ANALYSIS MEANS
READ NET LIST INFORMATION
3901
READ TEST VECTOR INFORMATION
3902
FOR ALL POINTS IN TIME RECORDED IN TEST VECTOR, CALCULATE LOGIC CHANGES THAT OCCUR AT THE OUTPUT OF EACH CURRENT ESTIMATION OBJECT CIRCUIT DEVICE IN NETWORK AS A RESULT OF APPLYING LOGIC VALUES TO EXTERNAL TERMINAL OF NET LIST. STORE THE CALCULATED CHANGES.
3903
FROM THE NUMBER OF LOGIC CHANGES THAT OCCURRED AT THE OUTPUT OF EACH CIRCUIT DEVICE, SELECT A PREDETERMINED NUMBER OF CIRCUIT DEVICES IN THE ORDER OF LOGIC CHANGE NUMBER AND SET THEM AS CURRENT ESTIMATION OBJECTS
3904
FROM THE LOGIC CHANGE INFORMATION FOR THE CURRENT ESTIMATION OBJECT CIRCUIT DEVICES, ESTIMATE POWER SUPPLY CURRENT INFORMATION, PERFORM FFT ON THE ESTIMATED POWER SUPPLY CURRENTS AND STORE THE RESULT
3905
END CURRENT FFT ANALYSIS MEANS

FIG. 40

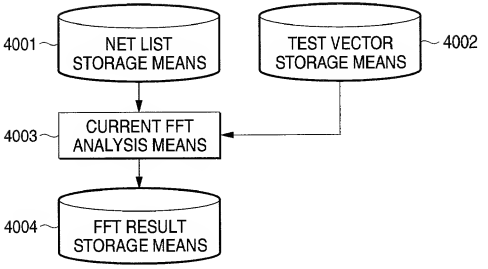

4001
NET LIST STORAGE MEANS
TEST VECTOR STORAGE MEANS
4002
4003
CURRENT FFT ANALYSIS MEANS
4004
FFT RESULT STORAGE MEANS

FIG. 41

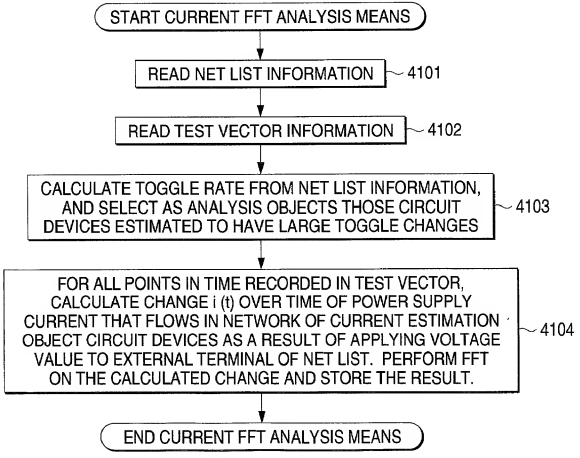

START CURRENT FFT ANALYSIS MEANS
READ NET LIST INFORMATION
4101
READ TEST VECTOR INFORMATION
4102
CALCULATE TOGGLE RATE FROM NET LIST INFORMATION, AND SELECT AS ANALYSIS OBJECTS THOSE CIRCUIT DEVICES ESTIMATED TO HAVE LARGE TOGGLE CHANGES
4103
FOR ALL POINTS IN TIME RECORDED IN TEST VECTOR, CALCULATE CHANGE i (t) OVER TIME OF POWER SUPPLY CURRENT THAT FLOWS IN NETWORK OF CURRENT ESTIMATION OBJECT CIRCUIT DEVICES AS A RESULT OF APPLYING VOLTAGE VALUE TO EXTERNAL TERMINAL OF NET LIST. PERFORM FFT ON THE CALCULATED CHANGE AND STORE THE RESULT.
4104
END CURRENT FFT ANALYSIS MEANS

FIG. 42

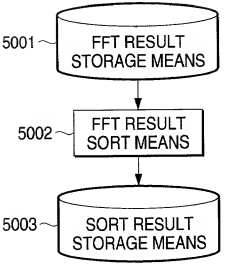

5001
FFT RESULT STORAGE MEANS
5002
FFT RESULT SORT MEANS
5003
SORT RESULT STORAGE MEANS

FIG. 43

51

INSTANCE NAME	FREQUENCY OF FFT RESULT	CURRENT FREQUENCY COMPONENT
M1	50	1.1
	100	1.7
	150	2.0
	200	1.9
	250	1.6
	300	0.8
	350	1.5
	400	1.8
M2	50	1.5
	100	2.0
	150	1.6
	200	0.9
	250	1.2
	300	1.5
	350	1.7
	400	1.1

5101 5102 5103

FIG. 44

52

FREQUENCY	INSTANCE	CURRENT FREQUENCY COMPONENT
50	M4	2.0
	M3	1.8
	M8	1.7
	M2	1.5
	M7	1.4
	M5	1.3
	M1	1.1
	M6	0.9
100	M2	2.0
	M6	1.9
	M5	1.8
	M1	1.7
	M4	1.5
	M3	1.3
	M6	1.1
	M7	1.0

5201 5202 5203

FIG. 45

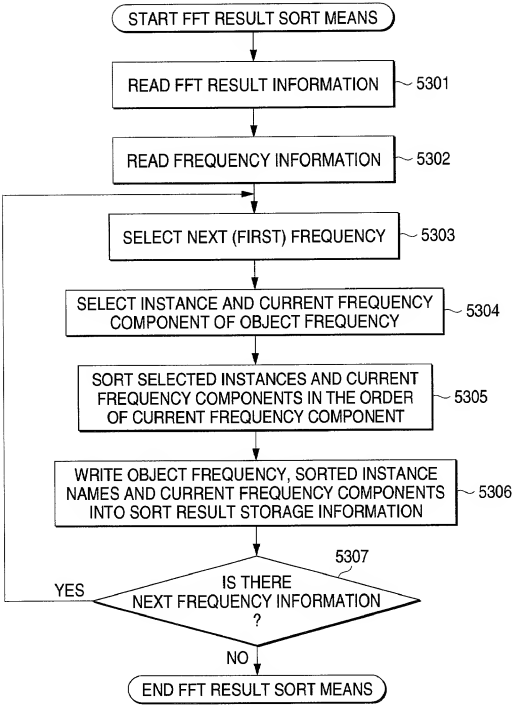

START FFT RESULT SORT MEANS
READ FFT RESULT INFORMATION
5301
READ FREQUENCY INFORMATION
5302
SELECT NEXT (FIRST) FREQUENCY
5303
SELECT INSTANCE AND CURRENT FREQUENCY COMPONENT OF OBJECT FREQUENCY
5304
SORT SELECTED INSTANCES AND CURRENT FREQUENCY COMPONENTS IN THE ORDER OF CURRENT FREQUENCY COMPONENT
5305
WRITE OBJECT FREQUENCY, SORTED INSTANCE NAMES AND CURRENT FREQUENCY COMPONENTS INTO SORT RESULT STORAGE INFORMATION
5306
5307
IS THERE NEXT FREQUENCY INFORMATION ?
YES
NO
END FFT RESULT SORT MEANS

FIG. 46

54

INSTANCE GROUP	FREQUENCY OF FFT RESULT	CURRENT FREQUENCY COMPONENT
G1	50	1.1
	100	1.7
	150	2.0
	200	1.9
	250	1.6
	300	0.8
	350	1.5
	400	1.8
G2	50	1.5
	100	2.0
	150	1.6
	200	0.9
	250	1.2
	300	1.5
	350	1.7
	400	1.1

5401 5402 5403

FIG. 47

FREQUENCY	INSTANCE GROUP	CURRENT FREQUENCY COMPONENT
50	G4	2.0
	G3	1.8
	G8	1.7
	G2	1.5
	G7	1.4
	G5	1.3
	G1	1.1
	G6	0.9
100	G2	2.0
	G6	1.9
	G5	1.8
	G1	1.7
	G4	1.5
	G3	1.3
	G6	1.1
	G7	1.0

5501 5502 5503

FIG. 48

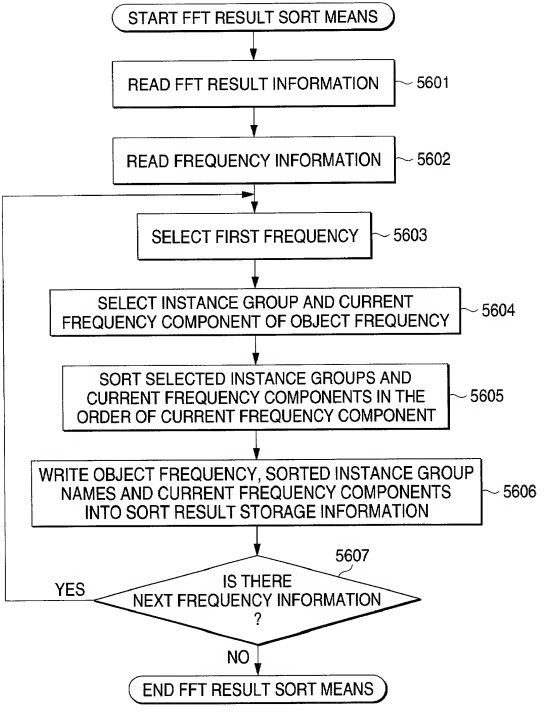

START FFT RESULT SORT MEANS
READ FFT RESULT INFORMATION
5601
READ FREQUENCY INFORMATION
5602
SELECT FIRST FREQUENCY
5603
SELECT INSTANCE GROUP AND CURRENT FREQUENCY COMPONENT OF OBJECT FREQUENCY
5604
SORT SELECTED INSTANCE GROUPS AND CURRENT FREQUENCY COMPONENTS IN THE ORDER OF CURRENT FREQUENCY COMPONENT
5605
WRITE OBJECT FREQUENCY, SORTED INSTANCE GROUP NAMES AND CURRENT FREQUENCY COMPONENTS INTO SORT RESULT STORAGE INFORMATION
5606
5607
IS THERE NEXT FREQUENCY INFORMATION ?
YES
NO
END FFT RESULT SORT MEANS

FIG. 49

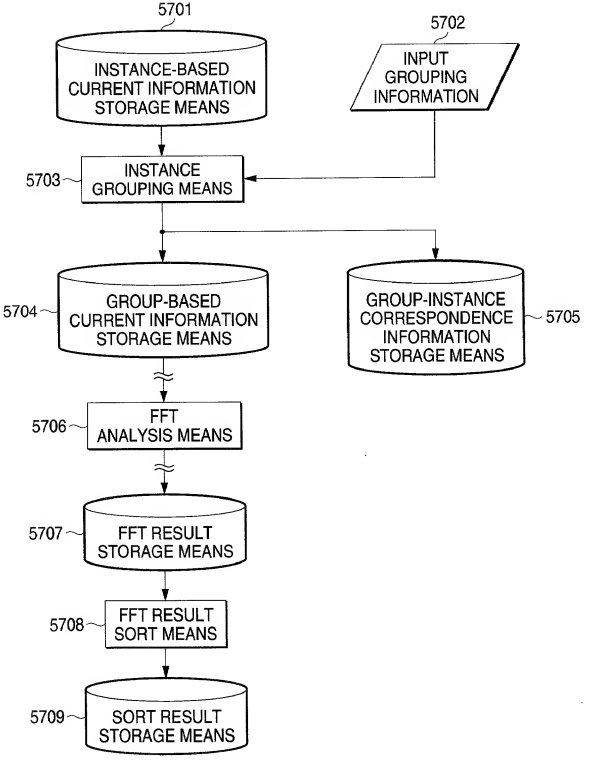

5701
INSTANCE-BASED CURRENT INFORMATION STORAGE MEANS
5702
INPUT GROUPING INFORMATION
5703
INSTANCE GROUPING MEANS
5704
GROUP-BASED CURRENT INFORMATION STORAGE MEANS
GROUP-INSTANCE CORRESPONDENCE INFORMATION STORAGE MEANS
5705
5706
FFT ANALYSIS MEANS
5707
FFT RESULT STORAGE MEANS
5708
FFT RESULT SORT MEANS
5709
SORT RESULT STORAGE MEANS

FIG. 50

INSTANCE NAME	TIME	CURRENT
M1	50	2
	100	1
	150	3
	200	2
	250	4
	300	1
	350	2
	400	3
M2	50	5
	100	7
	150	9
	200	6
	250	4
	300	5
	350	3
	400	5

5801 5802 5803

FIG. 51

CELL INFORMATION	PROPERTY INFORMATION
AND	1
OR	1
FF	2
SRAM	3
DRAM	3
IO1	4
IO2	4
⋮	⋮

5901 5902

FIG. 52

INSTANCE GROUP	TIME	CURRENT
G1	50	20
	100	10
	150	30
	200	20
	250	40
	300	10
	350	20
	400	30
G2	50	50
	100	70
	150	90
	200	60
	250	40
	300	50
	350	30
	400	50

6001 6002 6003

FIG. 53

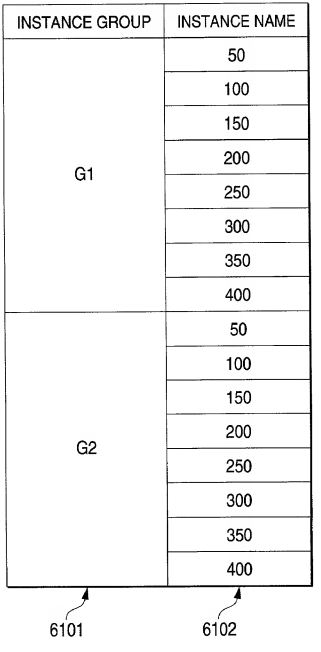

INSTANCE GROUP
INSTANCE NAME
G1
50
100
150
200
250
300
350
400
G2
50
100
150
200
250
300
350
400
6101
6102

FIG. 54

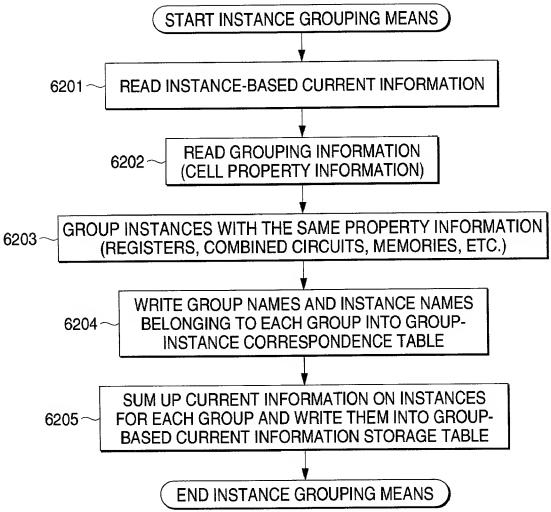

START INSTANCE GROUPING MEANS
6201
READ INSTANCE-BASED CURRENT INFORMATION
6202
READ GROUPING INFORMATION (CELL PROPERTY INFORMATION)
6203
GROUP INSTANCES WITH THE SAME PROPERTY INFORMATION (REGISTERS, COMBINED CIRCUITS, MEMORIES, ETC.)
6204
WRITE GROUP NAMES AND INSTANCE NAMES BELONGING TO EACH GROUP INTO GROUP-INSTANCE CORRESPONDENCE TABLE
6205
SUM UP CURRENT INFORMATION ON INSTANCES FOR EACH GROUP AND WRITE THEM INTO GROUP-BASED CURRENT INFORMATION STORAGE TABLE
END INSTANCE GROUPING MEANS

FIG. 55

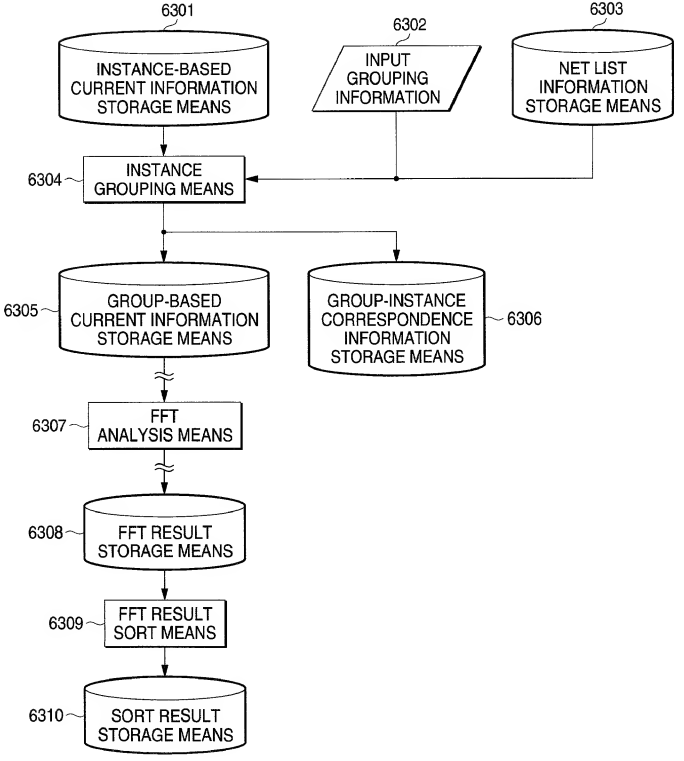
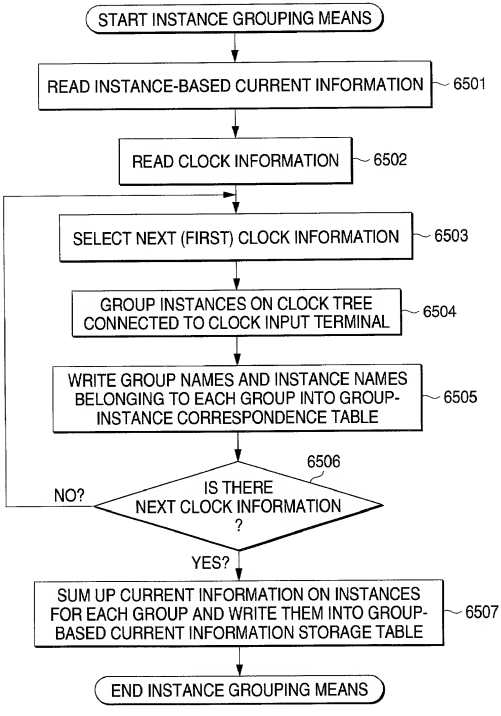

6301
INSTANCE-BASED CURRENT INFORMATION STORAGE MEANS
6302
INPUT GROUPING INFORMATION
6303
NET LIST INFORMATION STORAGE MEANS
6304
INSTANCE GROUPING MEANS
6305
GROUP-BASED CURRENT INFORMATION STORAGE MEANS
GROUP-INSTANCE CORRESPONDENCE INFORMATION STORAGE MEANS
6306
6307
FFT ANALYSIS MEANS
6308
FFT RESULT STORAGE MEANS
6309
FFT RESULT SORT MEANS
6310
SORT RESULT STORAGE MEANS

FIG. 56

GROUPING NUMBER	CLOCK TERMINAL NAME
1	CLK1
2	CLK2
3	CLK3
4	CLK4
5	CLK5
6	CLK6
7	CLK7
⋮	⋮
⋮	⋮
⋮	⋮

6401 6402

FIG. 57


START INSTANCE GROUPING MEANS
READ INSTANCE-BASED CURRENT INFORMATION
6501
READ CLOCK INFORMATION
6502
SELECT NEXT (FIRST) CLOCK INFORMATION
6503
GROUP INSTANCES ON CLOCK TREE CONNECTED TO CLOCK INPUT TERMINAL
6504
WRITE GROUP NAMES AND INSTANCE NAMES BELONGING TO EACH GROUP INTO GROUP-INSTANCE CORRESPONDENCE TABLE
6505
6506
IS THERE NEXT CLOCK INFORMATION ?
NO?
YES?
SUM UP CURRENT INFORMATION ON INSTANCES FOR EACH GROUP AND WRITE THEM INTO GROUP-BASED CURRENT INFORMATION STORAGE TABLE
6507
END INSTANCE GROUPING MEANS

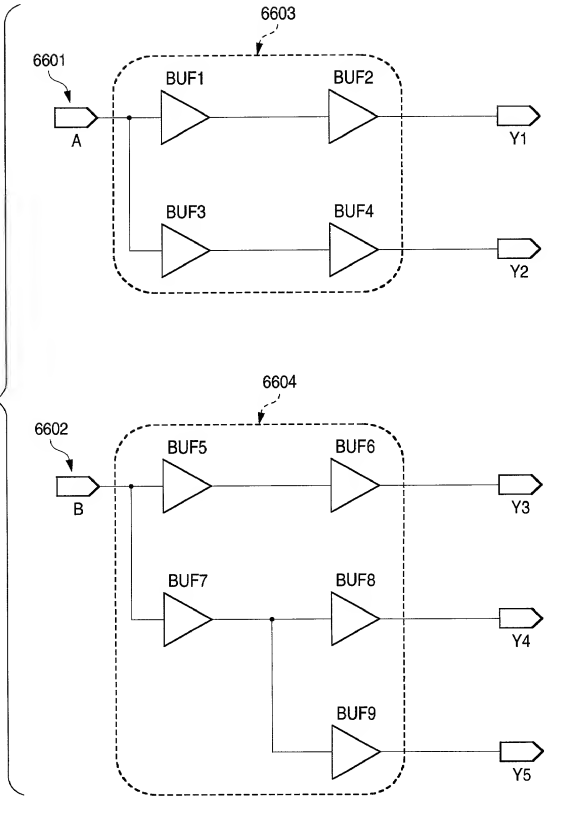


FIG. 58

FIG. 59

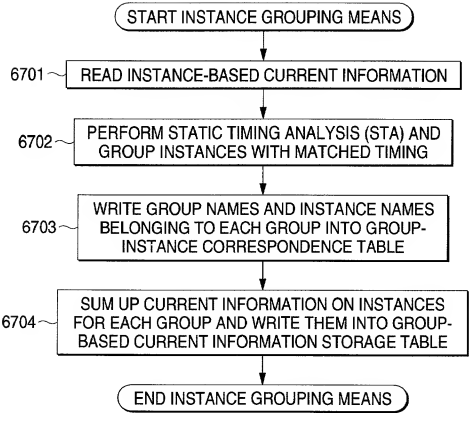

START INSTANCE GROUPING MEANS
6701
READ INSTANCE-BASED CURRENT INFORMATION
6702
PERFORM STATIC TIMING ANALYSIS (STA) AND GROUP INSTANCES WITH MATCHED TIMING
6703
WRITE GROUP NAMES AND INSTANCE NAMES BELONGING TO EACH GROUP INTO GROUP-INSTANCE CORRESPONDENCE TABLE
6704
SUM UP CURRENT INFORMATION ON INSTANCES FOR EACH GROUP AND WRITE THEM INTO GROUP-BASED CURRENT INFORMATION STORAGE TABLE
END INSTANCE GROUPING MEANS

FIG. 60

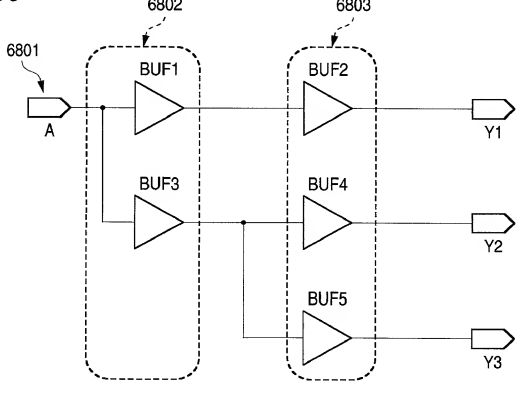

6802
6803
6801
BUF1
BUF2
A
Y1
BUF3
BUF4
Y2
BUF5
Y3

FIG. 61

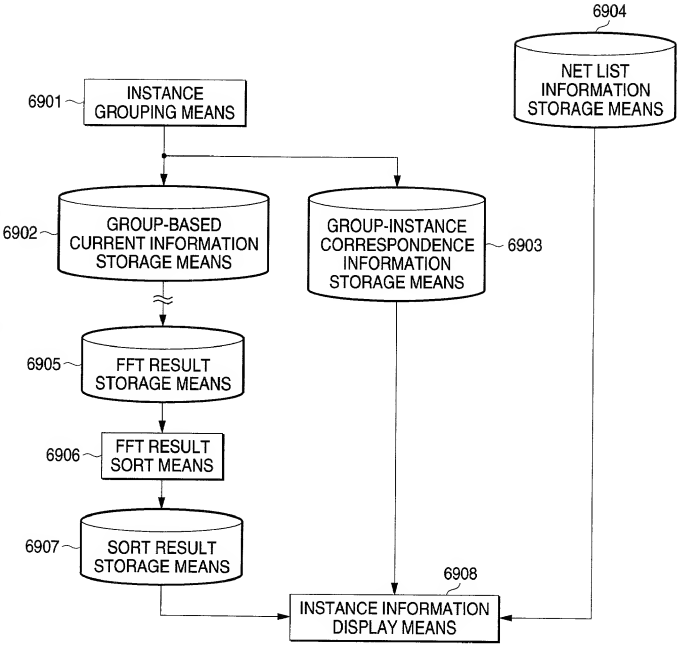

6904
NET LIST INFORMATION STORAGE MEANS
6901
INSTANCE GROUPING MEANS
6902
GROUP-BASED CURRENT INFORMATION STORAGE MEANS
GROUP-INSTANCE CORRESPONDENCE INFORMATION STORAGE MEANS
6903
6905
FFT RESULT STORAGE MEANS
6906
FFT RESULT SORT MEANS
6907
SORT RESULT STORAGE MEANS
6908
INSTANCE INFORMATION DISPLAY MEANS

FIG. 62

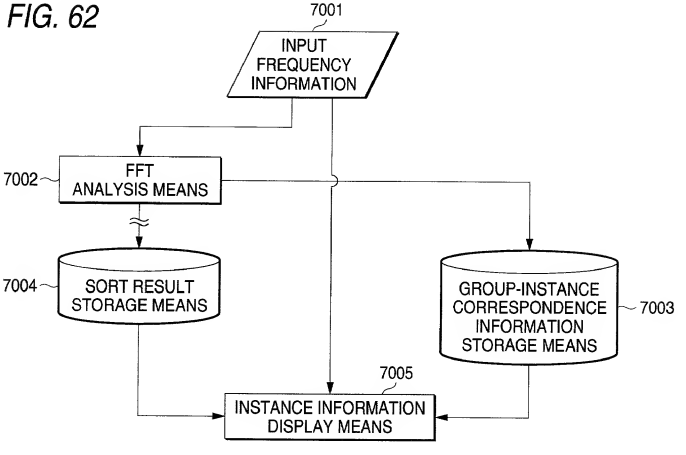

7001
INPUT FREQUENCY INFORMATION
7002
FFT ANALYSIS MEANS
7004
SORT RESULT STORAGE MEANS
GROUP-INSTANCE CORRESPONDENCE INFORMATION STORAGE MEANS
7003
7005
INSTANCE INFORMATION DISPLAY MEANS

FIG. 63

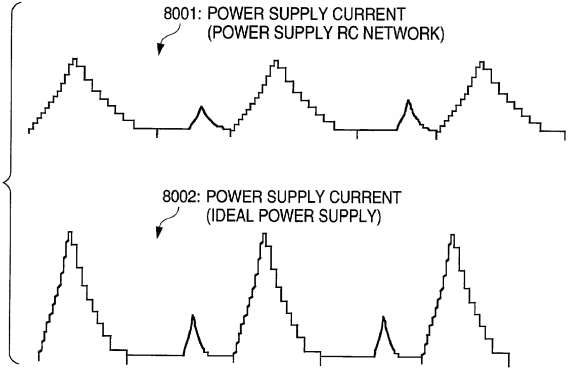

8001: POWER SUPPLY CURRENT (POWER SUPPLY RC NETWORK)
8002: POWER SUPPLY CURRENT (IDEAL POWER SUPPLY)

FIG. 64

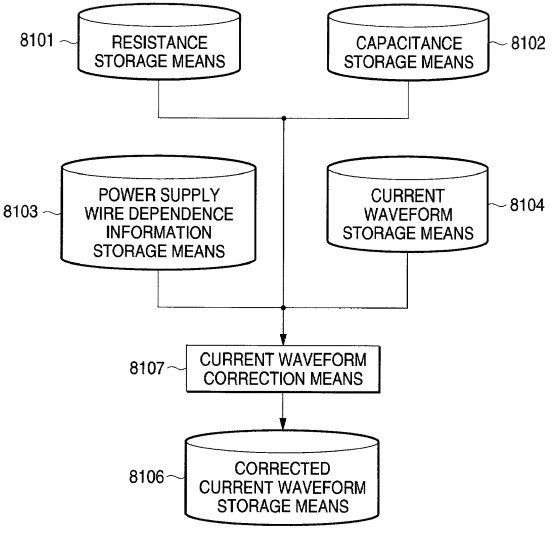

8101
RESISTANCE STORAGE MEANS
CAPACITANCE STORAGE MEANS
8102
8103
POWER SUPPLY WIRE DEPENDENCE INFORMATION STORAGE MEANS
CURRENT WAVEFORM STORAGE MEANS
8104
8107
CURRENT WAVEFORM CORRECTION MEANS
8106
CORRECTED CURRENT WAVEFORM STORAGE MEANS

FIG. 65

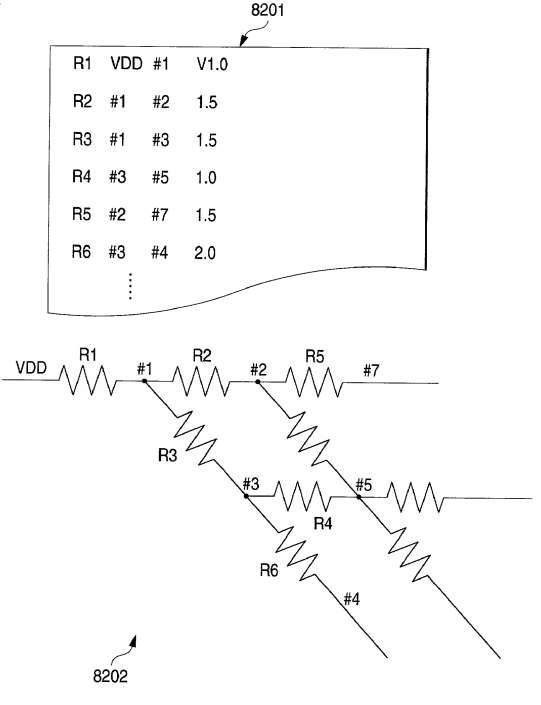

8201
R1 VDD #1 V1.0
R2 #1 #2 1.5
R3 #1 #3 1.5
R4 #3 #5 1.0
R5 #2 #7 1.5
R6 #3 #4 2.0
VDD
R1
#1
R2
#2
R5
#7
R3
#3
#5
R4
R6
#4
8202

FIG. 66

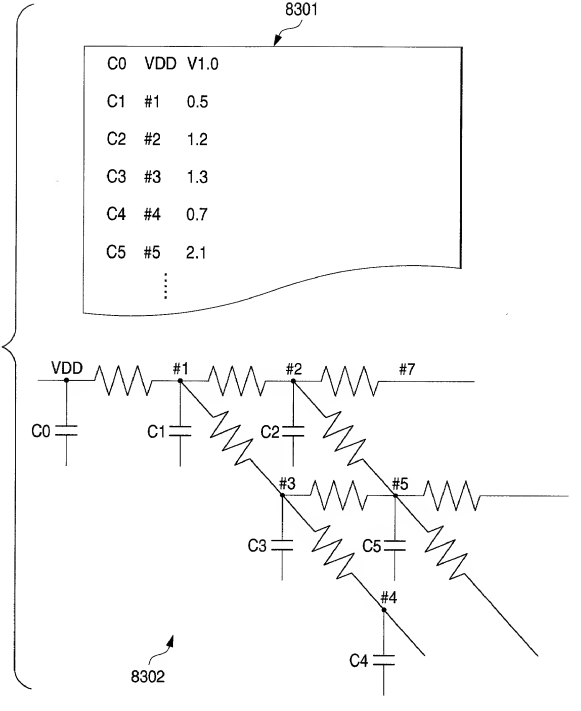

8301
C0 VDD V1.0
C1 #1 0.5
C2 #2 1.2
C3 #3 1.3
C4 #4 0.7
C5 #5 2.1
VDD
#1
#2
#7
C0
C1
C2
#3
#5
C3
C5
#4
C4
8302

FIG. 67

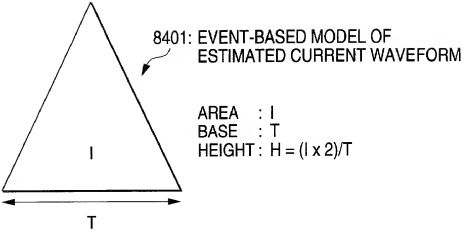

8401: EVENT-BASED MODEL OF
ESTIMATED CURRENT WAVEFORM
AREA : I
BASE : T
HEIGHT : H = (I x 2)/T
I
T

FIG. 68

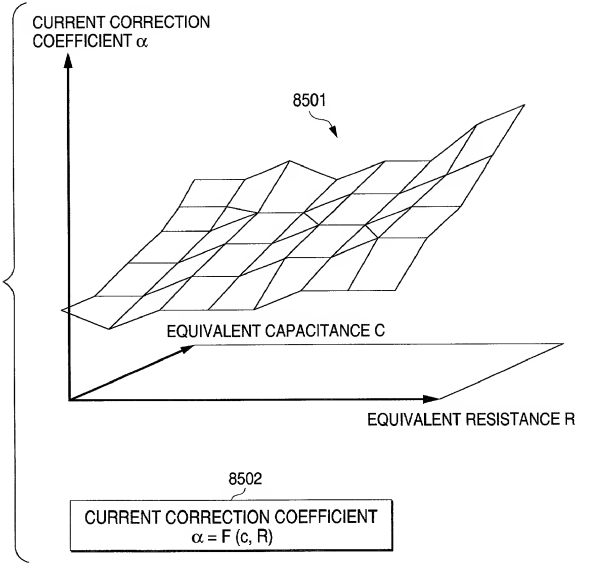

CURRENT CORRECTION
COEFFICIENT α
8501
EQUIVALENT CAPACITANCE C
EQUIVALENT RESISTANCE R
8502
CURRENT CORRECTION COEFFICIENT
α = F (c, R)

FIG. 69

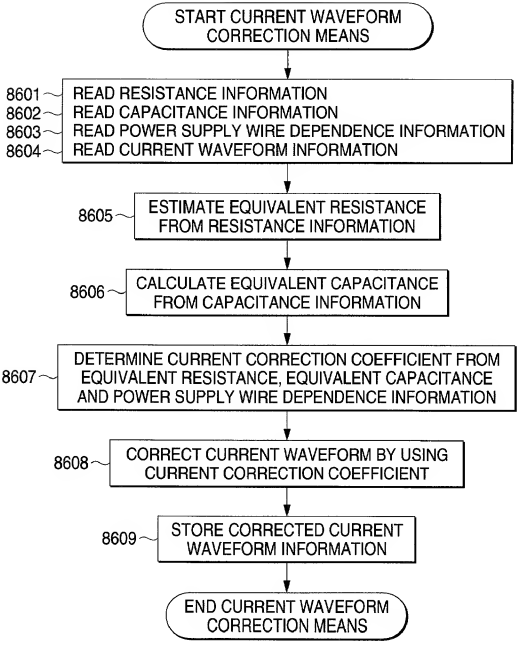

START CURRENT WAVEFORM CORRECTION MEANS
8601 READ RESISTANCE INFORMATION
8602 READ CAPACITANCE INFORMATION
8603 READ POWER SUPPLY WIRE DEPENDENCE INFORMATION
8604 READ CURRENT WAVEFORM INFORMATION
8605 ESTIMATE EQUIVALENT RESISTANCE FROM RESISTANCE INFORMATION
8606 CALCULATE EQUIVALENT CAPACITANCE FROM CAPACITANCE INFORMATION
8607 DETERMINE CURRENT CORRECTION COEFFICIENT FROM EQUIVALENT RESISTANCE, EQUIVALENT CAPACITANCE AND POWER SUPPLY WIRE DEPENDENCE INFORMATION
8608 CORRECT CURRENT WAVEFORM BY USING CURRENT CORRECTION COEFFICIENT
8609 STORE CORRECTED CURRENT WAVEFORM INFORMATION
END CURRENT WAVEFORM CORRECTION MEANS

FIG. 70

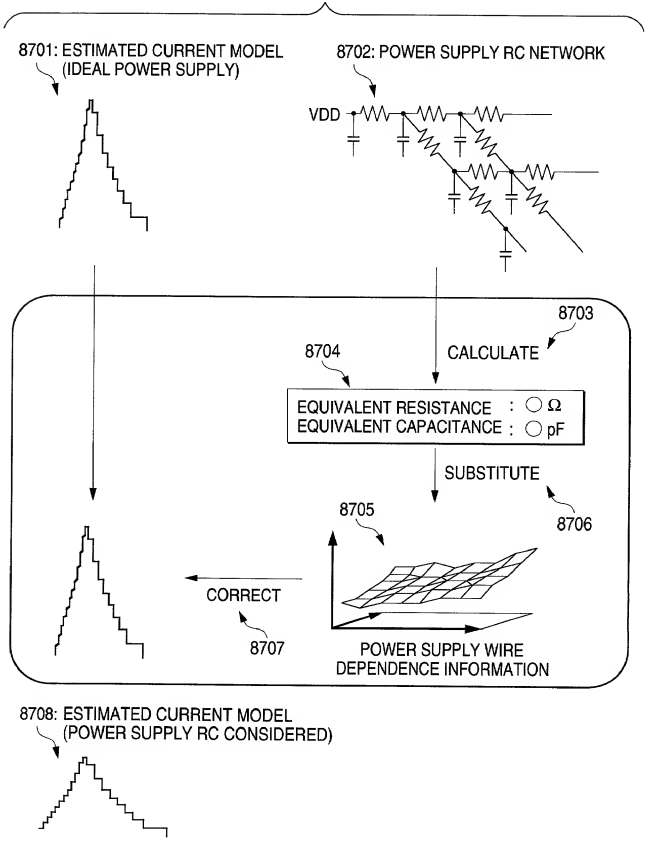

8701: ESTIMATED CURRENT MODEL
(IDEAL POWER SUPPLY)
8702: POWER SUPPLY RC NETWORK
VDD
8703
8704
CALCULATE
EQUIVALENT RESISTANCE : ○ Ω
EQUIVALENT CAPACITANCE : ○ pF
SUBSTITUTE
8705
8706
CORRECT
8707
POWER SUPPLY WIRE
DEPENDENCE INFORMATION
8708: ESTIMATED CURRENT MODEL
(POWER SUPPLY RC CONSIDERED)

FIG. 71

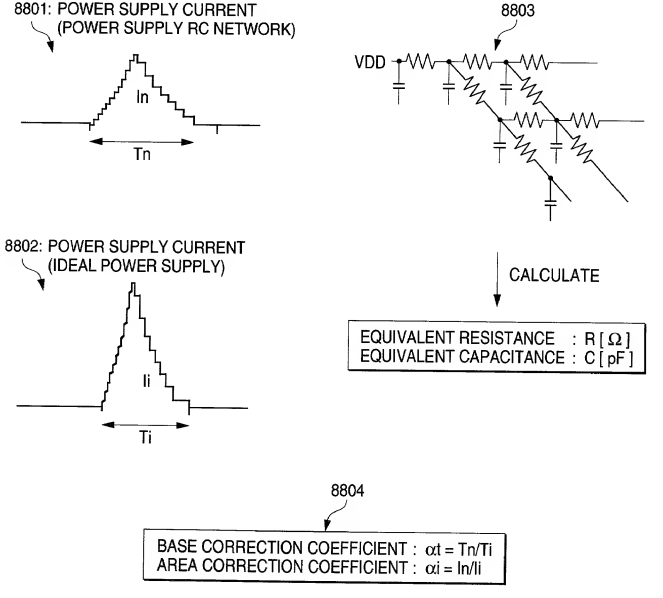

8801: POWER SUPPLY CURRENT
(POWER SUPPLY RC NETWORK)
In
Tn
8803
VDD
8802: POWER SUPPLY CURRENT
(IDEAL POWER SUPPLY)
Ii
Ti
CALCULATE
EQUIVALENT RESISTANCE : R [Ω]
EQUIVALENT CAPACITANCE : C [pF]
8804
BASE CORRECTION COEFFICIENT : αt = Tn/Ti
AREA CORRECTION COEFFICIENT : αi = In/Ii

FIG. 72

EQUIVALENT RESISTANCE

(1) CALCULATE RESISTANCE FOR EACH JUNCTION

8901

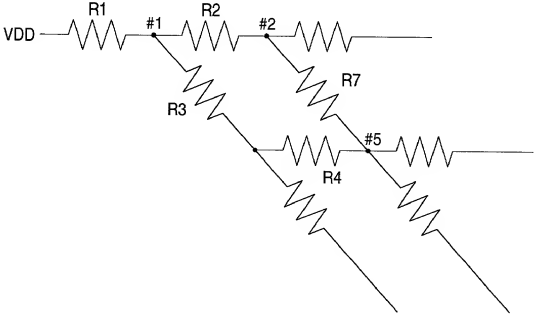
#1 = R1

⋮

#5 = R1 + { { (R2 + R7) x (R3 + R4) } / { (R2 + R7) + (R3 + R4) } }

⋮

(1) CALCULATE AVERAGE
→ USE IT AS EQUIVALENT RESISTANCE OF CHIP



EQUIVALENT CAPACITANCE

(1) SUM UP CAPACITANCES OF CHIP
→ USE IT AS EQUIVALENT CAPACITANCE

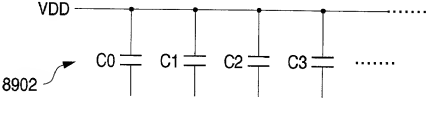


FIG. 73

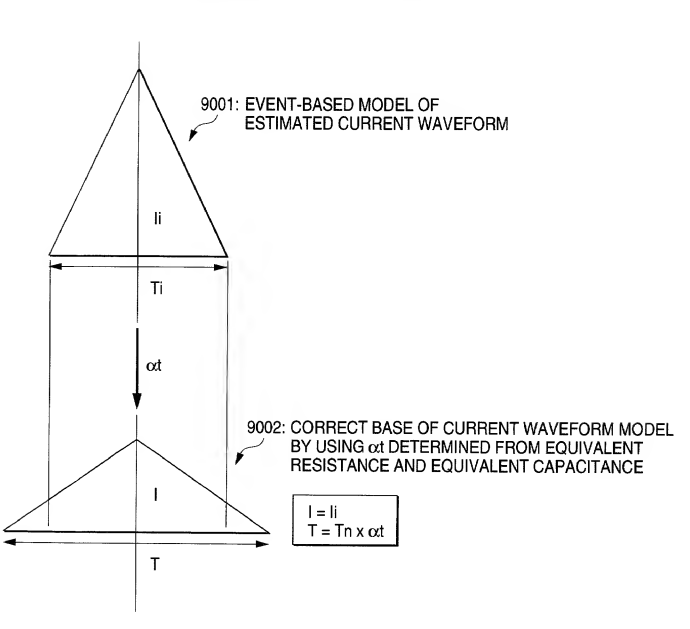

DECOUPLING INFLUENCE IS REFLECTED
9001: EVENT-BASED MODEL OF ESTIMATED CURRENT WAVEFORM
Ii
Ti
αt
9002: CORRECT BASE OF CURRENT WAVEFORM MODEL BY USING αt DETERMINED FROM EQUIVALENT RESISTANCE AND EQUIVALENT CAPACITANCE
I
T
I = Ii
T = Tn x αt

FIG. 74

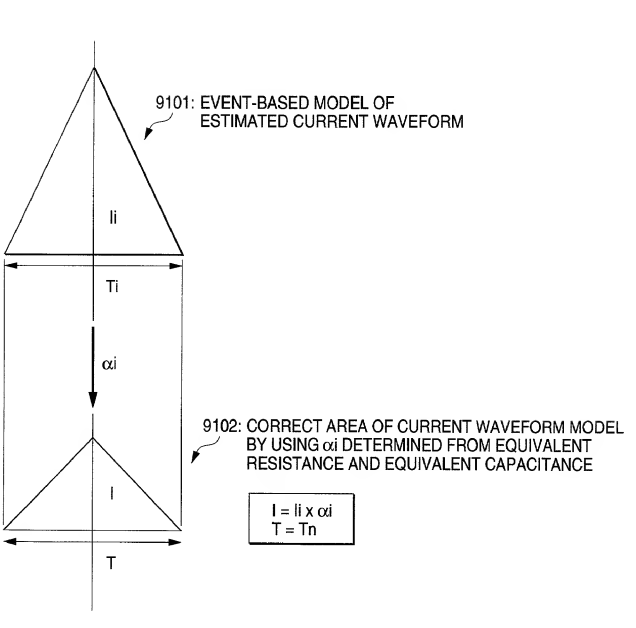

IR-DROP INFLUENCE IS REFLECTED
9101: EVENT-BASED MODEL OF ESTIMATED CURRENT WAVEFORM
Ii
Ti
αi
9102: CORRECT AREA OF CURRENT WAVEFORM MODEL BY USING αi DETERMINED FROM EQUIVALENT RESISTANCE AND EQUIVALENT CAPACITANCE
I = Ii x αi
T = Tn
I
T

FIG. 75

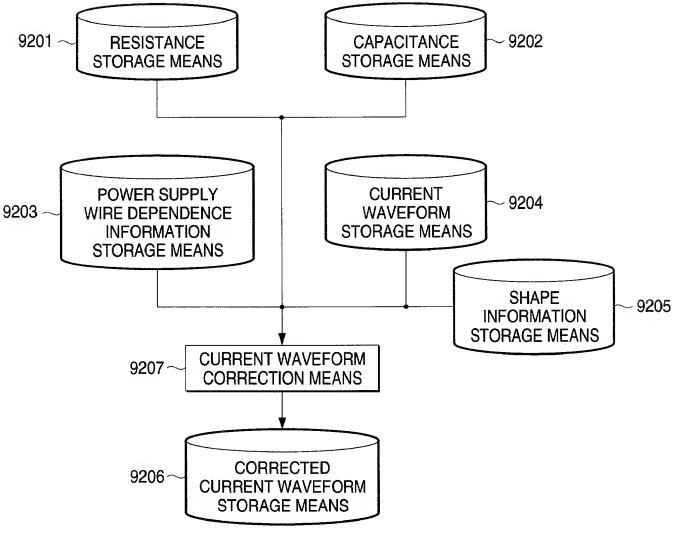

9201
RESISTANCE STORAGE MEANS
CAPACITANCE STORAGE MEANS
9202
9203
POWER SUPPLY WIRE DEPENDENCE INFORMATION STORAGE MEANS
CURRENT WAVEFORM STORAGE MEANS
9204
SHAPE INFORMATION STORAGE MEANS
9205
9207
CURRENT WAVEFORM CORRECTION MEANS
9206
CORRECTED CURRENT WAVEFORM STORAGE MEANS

FIG. 76

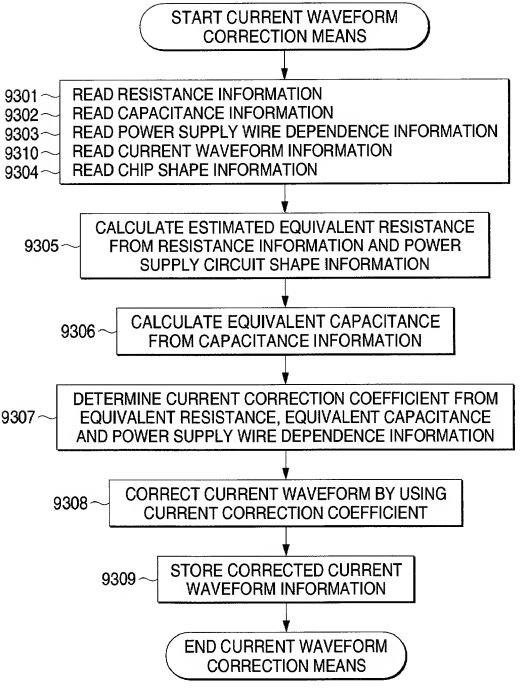

START CURRENT WAVEFORM CORRECTION MEANS
9301 READ RESISTANCE INFORMATION
9302 READ CAPACITANCE INFORMATION
9303 READ POWER SUPPLY WIRE DEPENDENCE INFORMATION
9310 READ CURRENT WAVEFORM INFORMATION
9304 READ CHIP SHAPE INFORMATION
9305 CALCULATE ESTIMATED EQUIVALENT RESISTANCE FROM RESISTANCE INFORMATION AND POWER SUPPLY CIRCUIT SHAPE INFORMATION
9306 CALCULATE EQUIVALENT CAPACITANCE FROM CAPACITANCE INFORMATION
9307 DETERMINE CURRENT CORRECTION COEFFICIENT FROM EQUIVALENT RESISTANCE, EQUIVALENT CAPACITANCE AND POWER SUPPLY WIRE DEPENDENCE INFORMATION
9308 CORRECT CURRENT WAVEFORM BY USING CURRENT CORRECTION COEFFICIENT
9309 STORE CORRECTED CURRENT WAVEFORM INFORMATION
END CURRENT WAVEFORM CORRECTION MEANS

FIG. 77

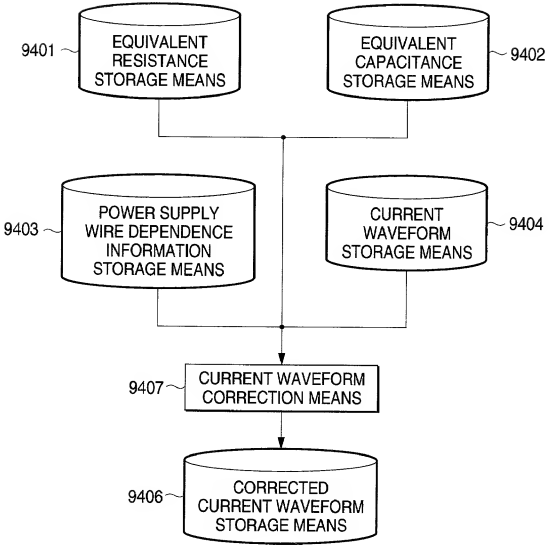

9401
EQUIVALENT RESISTANCE STORAGE MEANS
EQUIVALENT CAPACITANCE STORAGE MEANS
9402
9403
POWER SUPPLY WIRE DEPENDENCE INFORMATION STORAGE MEANS
CURRENT WAVEFORM STORAGE MEANS
9404
9407
CURRENT WAVEFORM CORRECTION MEANS
9406
CORRECTED CURRENT WAVEFORM STORAGE MEANS

FIG. 78

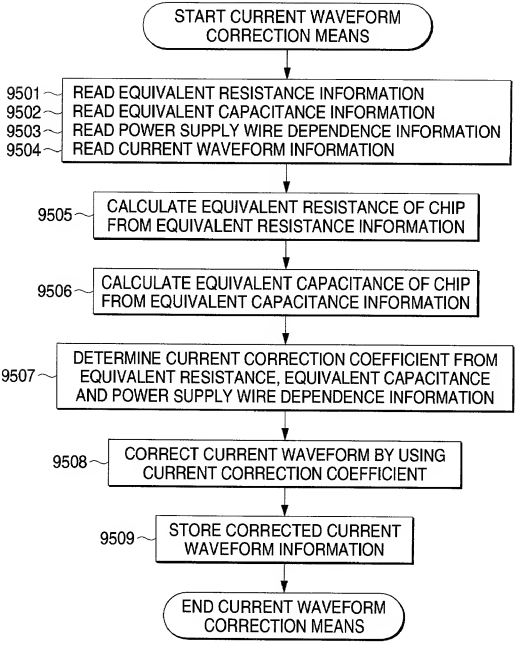

START CURRENT WAVEFORM CORRECTION MEANS
9501
READ EQUIVALENT RESISTANCE INFORMATION
9502
READ EQUIVALENT CAPACITANCE INFORMATION
9503
READ POWER SUPPLY WIRE DEPENDENCE INFORMATION
9504
READ CURRENT WAVEFORM INFORMATION
9505
CALCULATE EQUIVALENT RESISTANCE OF CHIP FROM EQUIVALENT RESISTANCE INFORMATION
9506
CALCULATE EQUIVALENT CAPACITANCE OF CHIP FROM EQUIVALENT CAPACITANCE INFORMATION
9507
DETERMINE CURRENT CORRECTION COEFFICIENT FROM EQUIVALENT RESISTANCE, EQUIVALENT CAPACITANCE AND POWER SUPPLY WIRE DEPENDENCE INFORMATION
9508
CORRECT CURRENT WAVEFORM BY USING CURRENT CORRECTION COEFFICIENT
9509
STORE CORRECTED CURRENT WAVEFORM INFORMATION
END CURRENT WAVEFORM CORRECTION MEANS

FIG. 79

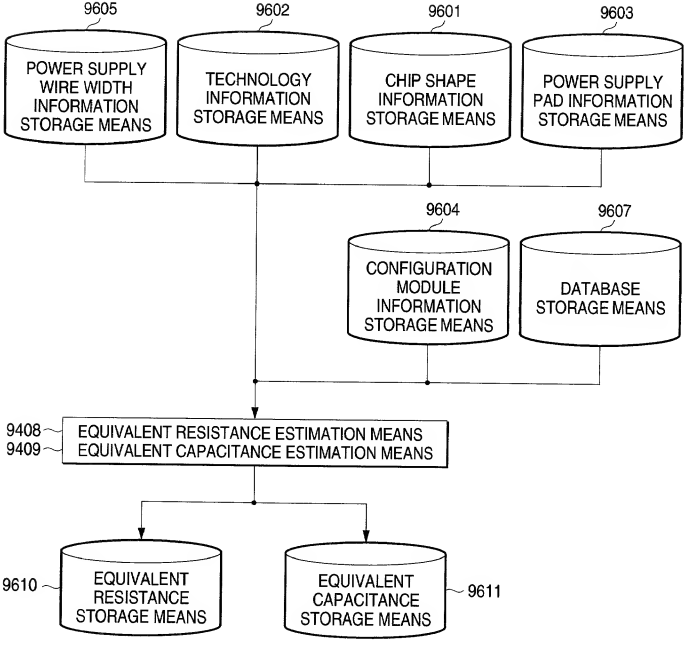

9605
POWER SUPPLY WIRE WIDTH INFORMATION STORAGE MEANS
9602
TECHNOLOGY INFORMATION STORAGE MEANS
9601
CHIP SHAPE INFORMATION STORAGE MEANS
9603
POWER SUPPLY PAD INFORMATION STORAGE MEANS
9604
CONFIGURATION MODULE INFORMATION STORAGE MEANS
9607
DATABASE STORAGE MEANS
9408
9409
EQUIVALENT RESISTANCE ESTIMATION MEANS
EQUIVALENT CAPACITANCE ESTIMATION MEANS
9610
EQUIVALENT RESISTANCE STORAGE MEANS
EQUIVALENT CAPACITANCE STORAGE MEANS
9611

FIG. 80

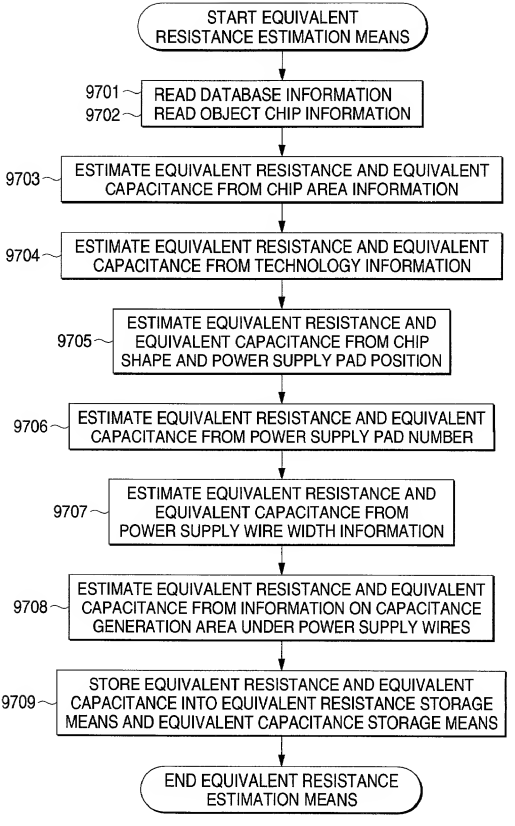

START EQUIVALENT RESISTANCE ESTIMATION MEANS
9701
9702
READ DATABASE INFORMATION
READ OBJECT CHIP INFORMATION
9703
ESTIMATE EQUIVALENT RESISTANCE AND EQUIVALENT CAPACITANCE FROM CHIP AREA INFORMATION
9704
ESTIMATE EQUIVALENT RESISTANCE AND EQUIVALENT CAPACITANCE FROM TECHNOLOGY INFORMATION
9705
ESTIMATE EQUIVALENT RESISTANCE AND EQUIVALENT CAPACITANCE FROM CHIP SHAPE AND POWER SUPPLY PAD POSITION
9706
ESTIMATE EQUIVALENT RESISTANCE AND EQUIVALENT CAPACITANCE FROM POWER SUPPLY PAD NUMBER
9707
ESTIMATE EQUIVALENT RESISTANCE AND EQUIVALENT CAPACITANCE FROM POWER SUPPLY WIRE WIDTH INFORMATION
9708
ESTIMATE EQUIVALENT RESISTANCE AND EQUIVALENT CAPACITANCE FROM INFORMATION ON CAPACITANCE GENERATION AREA UNDER POWER SUPPLY WIRES
9709
STORE EQUIVALENT RESISTANCE AND EQUIVALENT CAPACITANCE INTO EQUIVALENT RESISTANCE STORAGE MEANS AND EQUIVALENT CAPACITANCE STORAGE MEANS
END EQUIVALENT RESISTANCE ESTIMATION MEANS

FIG. 81

CHIP EQUIVALENT RESISTANCE	20Ω
CHIP EQUIVALENT CAPACITANCE	400pF
CHIP AREA CHIP SHAPE	$400mm^2$ 20.0mm x 20.0mm
NUMBER OF POWER SUPPLY PADS POWER SUPPLY PAD POSITION	1 (1000, 0)
TECHNOLOGY SHEET RESISTANCE UNIT PARASITIC CAPACITANCE	0.6um 100mΩ 1.0pF
RING POWER SUPPLY WIRE TRUNK POWER SUPPLY WIRE DECOUPLING CAPACITANCE CELL	PROVIDED, 50um 30um NOT PROVIDED
MODULE KIND MODULE AREA MODULE POSITION NUMBER OF INSTANCES IN-MODULE WIRE WIDTH PERIPHERAL CAPACITANCE CELL	STANDARD LOGIC (A) 8.0mm x 4.5mm (400, 800) 700,000 5um NOT PROVIDED
MODULE KIND MODULE AREA MODULE POSITION NUMBER OF INSTANCES IN-MODULE WIRE WIDTH PERIPHERAL CAPACITANCE CELL	RAM (B) 13.0mm x 2.0mm (1700, 1800) 300,000 – NOT PROVIDED
⋮	⋮

FIG. 82

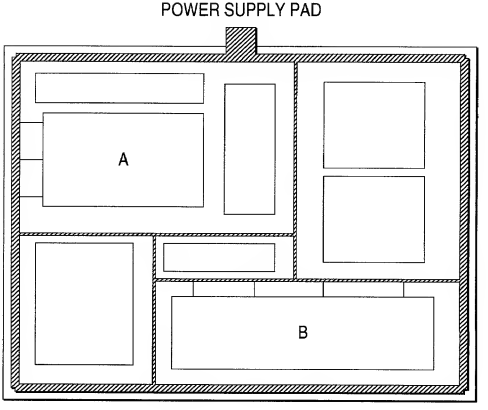


FIG. 83

CHIP EQUIVALENT RESISTANCE	?
CHIP EQUIVALENT CAPACITANCE	?
CHIP AREA CHIP SHAPE	1,600mm^2 80.0mm x 20.0mm
NUMBER OF POWER SUPPLY PADS POWER SUPPLY PAD POSITION	2 (4000, 0) (4000, 2000)
TECHNOLOGY SHEET RESISTANCE UNIT PARASITIC CAPACITANCE	0.6um 100mΩ 0.75pF
RING POWER SUPPLY WIRE TRUNK POWER SUPPLY WIRE DECOUPLING CAPACITANCE CELL	PROVIDED, 75um 45um INSERT UNDER RING POWER SUPPLY WIRE
MODULE KIND MODULE AREA MODULE POSITION NUMBER OF INSTANCES IN-MODULE WIRE WIDTH PERIPHERAL CAPACITANCE CELL	STANDARD LOGIC (C) 7.5mm x 15.0mm (400, 800) 700,000 5um NOT PROVIDED
MODULE KIND MODULE AREA MODULE POSITION NUMBER OF INSTANCES IN-MODULE WIRE WIDTH PERIPHERAL CAPACITANCE CELL	RAM (D) 4.0mm x 25.0mm (1700, 1800) 300,000 – NOT PROVIDED
⋮	⋮

FIG. 84

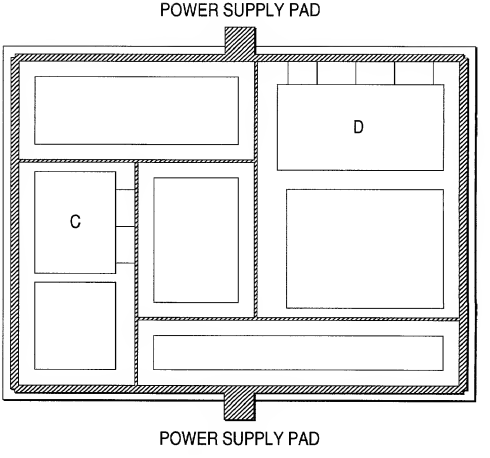


FIG. 85 (a)

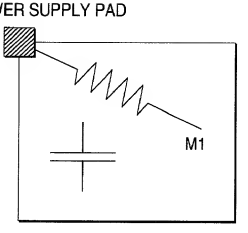


FIG. 85 (b)

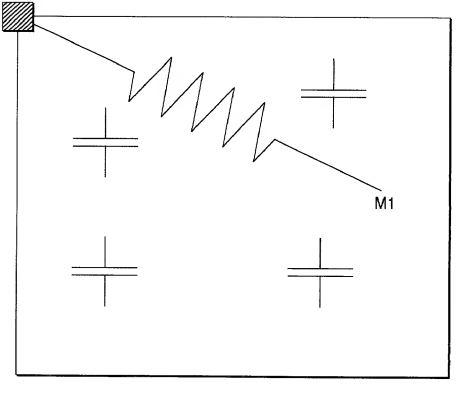


FIG. 86 (a)

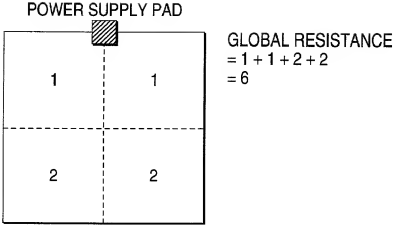


FIG. 86 (b)

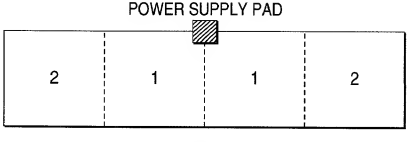


FIG. 86 (c)

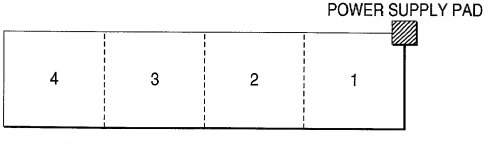


FIG. 87

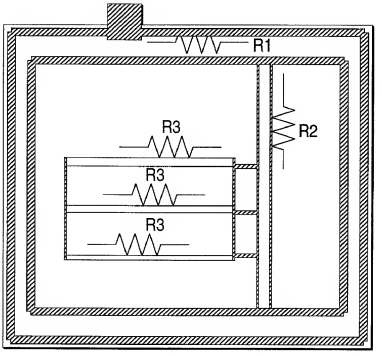


FIG. 88 (a)

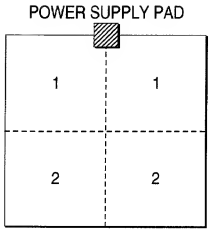


FIG. 88 (b)

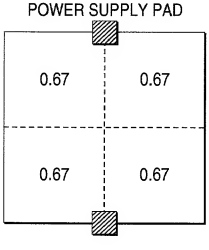


FIG. 88 (c)

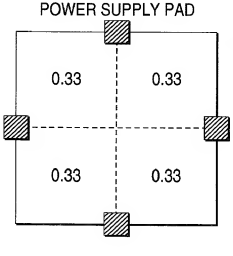


FIG. 89 (a)

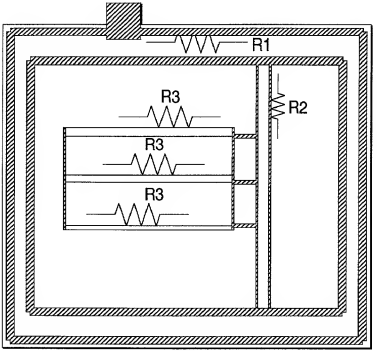


FIG. 89 (b)

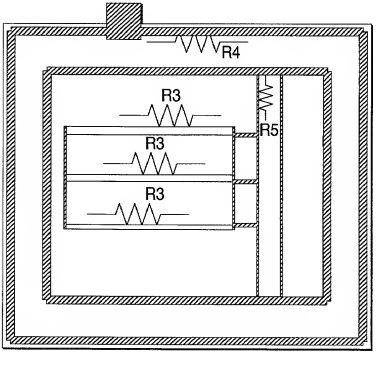


FIG. 90